

# Tongass Narrows Aviation Conditions Summary



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## 1.0 INTRODUCTION

Located between Revillagigedo and Gravina Islands 679 miles north of Seattle and 235 miles south of Juneau, the Tongass Narrows stretches from Nichols Passage to Guard Island. Though approximately 13 miles in length, at its narrowest point, the Tongass Narrows are no wider than  $\frac{1}{4}$  of a mile. Steep mountains rising over 2,000 feet bound this narrow passage on the east and west. These natural features create a funnel effect that requires aircraft and sea going vessels to operate in close proximity.

Each summer, over 480 cruise ships dock in Ketchikan, bringing over 300,000 visitors annually. Additionally, four canneries, three cold storage facilities, a single fish processing plant, and 438 area residents holding commercial fishing permits support Ketchikan's summer fishing industry. According to the *Tongass Narrows Voluntary Waterway Guide*, "a typical summer day in the Tongass Narrows may result in 500+ floatplane landings and takeoffs; 173 charter boat transits; 22 small passenger vessels; 4-6 large cruise ships with 1-2 at anchor; 150 fishing vessels at 7 canneries; 3-5 barge/tug transits; 30-40 kayaks; and an unknown number of recreational and transient boat traffic."

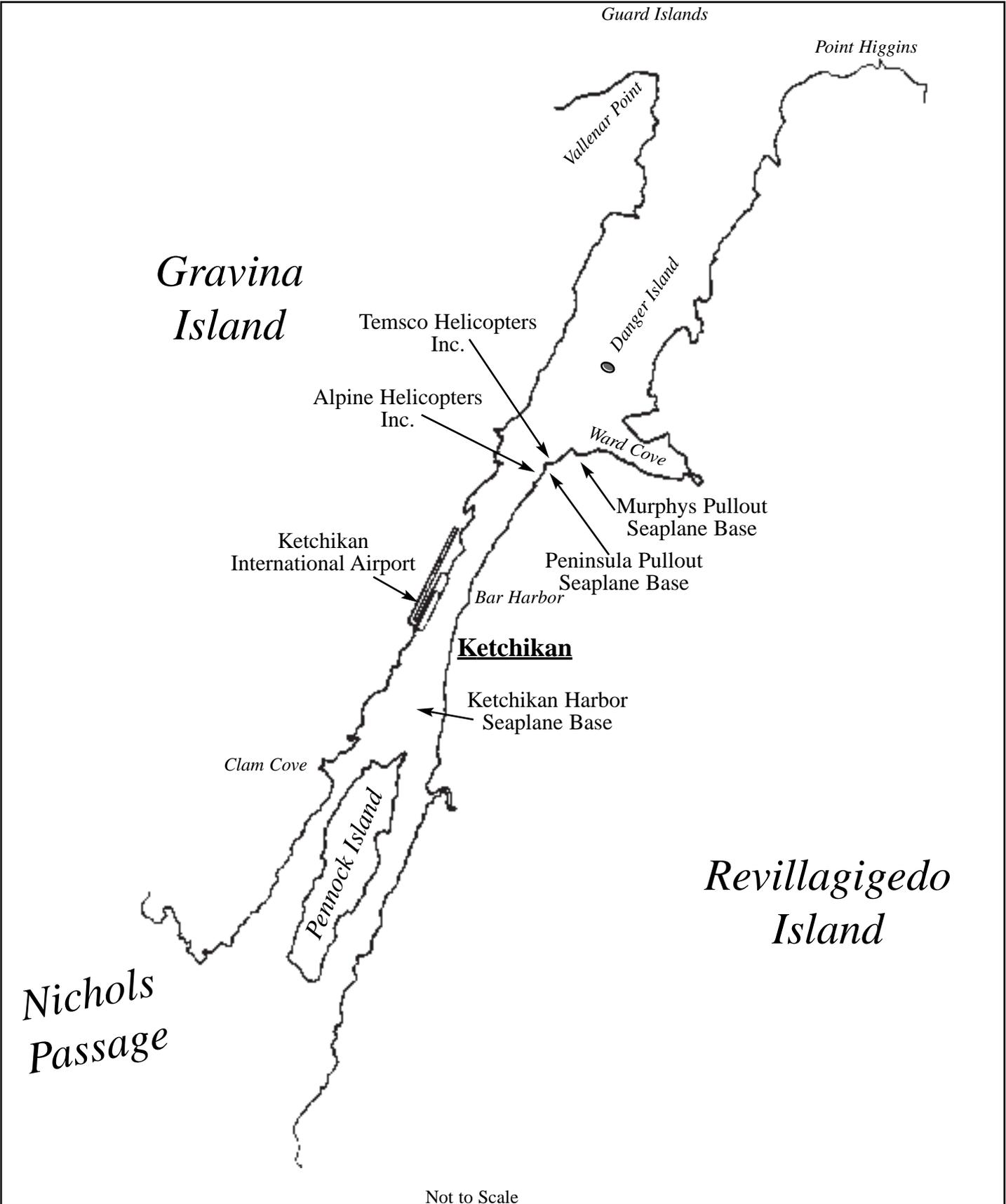
Four public aviation facilities exist within the Tongass Narrows boundaries; Ketchikan International Airport, Ketchikan Harbor Seaplane Base, Murphy's Pullout Seaplane Base, and Peninsula Point Seaplane Base (Figure 1). Numerous small private floatplane facilities and heliports also operate in the Narrows. Air traffic can exceed 100,000 operations annually, the majority of which occurs during the summer months at the height of the fishing and tourism season.

In combination, these elements create a greatly constricted and highly active channel. As a result, aviation and vessel activity in the Tongass Narrows is specially regulated under Federal Aviation Regulations and the Code of Federal Regulations. Additionally, the Department of Transportation and the United States Coast Guard have prepared documents recommending guidelines for the safe operation of aircraft and sea-going vessels in this area.

## 2.0 AVIATION FACILITIES AND OPERATIONS

### 2.1 Ketchikan International Airport

Ketchikan International Airport lies on Gravina Island and is accessed from the Ketchikan waterfront via a ten-minute ferry ride across the Tongass Narrows. The airport receives regularly scheduled daily north bound and south bound jet service. As a regional transportation hub, the airport supports many air taxi providers servicing surrounding communities. During the last five years this airport has experienced an annual average of 120,532 enplanements and 16,331 operations. Airport facilities include; one grooved asphalt and lighted 7,500 foot runway (11/29) and two (A&B) paved taxiways. Taxiway 'A' provides access between the terminal apron to runway 11/29. Taxiway 'B' provides access between the general aviation (GA) apron to the terminal apron. The airport has one aircraft apron divided into four separate aprons located northwest of runway 11/29. Located on the north side of runway 11/29, this approximately 7,570 square foot apron provides parking space for air carrier, air taxi, general



Not to Scale



**Vicinity Map**

**Figure 1**

aviation, and cargo aircraft. There is approximately space for 2 air carriers, 2 air taxi, 12 transient GA, and 1 cargo aircraft.

The runway is constrained topographically by mountains to the east and the Tongass Narrows to the west. The runway (11/29) is orientated in the only practical configuration, and is designed for use by aircraft with or below an airport reference code (ARC) of C-III (the 737-200 combi is the predominant C-III aircraft using the facility). The development of a crosswind runway at the existing location or the relocation of the airport would not be practical or feasible due to the surrounding limitations presented by the natural topography. Prior to Ketchikan International Airport's development, residents flew to the Metlaktla airport and took an air taxi floatplane over to the Ketchikan waterfront.

Floatplane aircraft are currently accommodated on the Tongass Narrows at two airport facilities towards the west end of runway 11/29. The first facility provides three transient docking spaces at a cost of five dollars a day. The second facility, according to the Ketchikan International Airport manager, is the largest floatplane dock in southeast Alaska. The dock can accommodate up to 12 Twin Otter aircraft at a time and is used for the loading and unloading of passengers and freight. Additionally, a concrete ramp is located in the area to facilitate removal of floatplanes for maintenance or storage. According to the Ketchikan International Airport manager, floatplane operations average approximately 7,000 annually, nearly one tenth of the operations conducted from the Ketchikan Harbor Seaplane Base (Chehall, August 1999).

## **2.2 Ketchikan Harbor Seaplane Base**

Southeast of the Ketchikan International Airport lies the Ketchikan Harbor Seaplane Base. This public domain facility consists of a 10,000-foot x 1,500-foot water runway oriented northwest to southeast on the north side of the Tongass Narrows adjacent to the city of Ketchikan and numerous privately owned air taxi floatplane docking facilities. The runway is open to public floatplane use but does not provide public or transient seaplane docking facilities. According to the Federal Aviation Administration's Airport Master Record (FAA 5010), 85% of the average 241 operations per day from this facility are conducted by air taxi aircraft. Only 11% of these operations are conducted by local general aviation and 3% are transient. The FAA 5010 states that operations from this facility exceed 85,000 annually. The nature of this facility precludes use by fixed wheeled aircraft therefore it is reasonable to assume that nearly all of these operations were conducted by floatplanes and/or amphibious aircraft.

## **2.3 Murphy's Pullout Seaplane Base**

Owned by the Ketchikan Gateway Borough and managed by the State, Murphy's Pullout is located five miles northwest of the City of Ketchikan. This facility consists of a 10,000 feet x 2,000 feet water runway oriented northeast to southwest on the north side of the Tongass Narrows in the vicinity of Ward Cove. This facility provides eight spaces for transient floatplane aircraft. According to Ketchikan Flight Service Station personnel, few operations (approximately 700 annually) occur at this facility (McDonald, August 1999).

## 2.4 Peninsula Point Seaplane Base

The Peninsula Point Seaplane Base has been abandoned for nearly ten years and is not currently maintained for aircraft use. This facility is comprised of a concrete ramp and one hangar. Rocks and debris at the entrance to this facility impede floatplane operations. Taquan Air leases space at Peninsula Point for aircraft storage. Temsco Heliport is a privately owned heliport that operates northeast of this facility (Chenhall, August 1999).

Table 1 presents operation records, capacity, and aircraft type accommodated at each public aviation facility in the Tongass Narrows.

**Table 1. Aviation Facility Characteristics**

Facility	Operations/Year	Aircraft Type	Aircraft Spaces
Ketchikan International Airport	16,208 <sup>1</sup>	Fixed Wheel	2 Air Carrier 2 Air Taxi 12 Transient GA
	7,000 <sup>2</sup>	Floatplane	1 Cargo
Ketchikan Harbor Seaplane Base	88,000 to 100,000*	Floatplane	0
Murphy's Pullout Seaplane Base	100 to 200*	Floatplane	8 (transient)
Peninsula Point Seaplane Base <sup>3</sup>	0	Floatplane	0
Temsco Helicopters Inc <sup>4</sup>	Summer Winter	Helicopter	20
	20 per day 6 per day		
Alpine Helicopters Inc. <sup>5</sup>	Summer Winter	Helicopter	3
	200 Per month 0-100 per month		

<sup>1</sup> Total operations for 1998. FAA, Terminal Area Forecast.

<sup>2</sup> Floatplane only operation data for this facility is not reported in the FAA Terminal Area Forecast (TAF). (Chenhall, 1999)

<sup>3</sup> This facility has been abandoned.

<sup>4</sup> (Hicks, 1999)

<sup>5</sup> (Bockmen 1999)

\* (McDonald, 1999)

## 2.5 Private Seaplane Facilities

Numerous private floatplane charter businesses operate along the northern shore of the Tongass Narrows. Some operators (Taquan Air) have built large docks to accommodate a substantial number of floatplanes while the majority of these businesses utilize one to two plane docks. Though the majority of these businesses operate from the Ketchikan Harbor area, a few operators have businesses beyond its boundaries.

### 3.0 STATEWIDE RANKING

According to the FAA 5010 Airport Master Record, total operations at Ketchikan Harbor reached 88,000 in 1988. Though dated, this information was gathered during the most recent airport inspection on April of 1988. The total number of operations reached in 1988 are still well within the range (80,000 to 100,000) of annual operations from Ketchikan harbor (McDonald, August 1999). Comparatively, Ketchikan Harbor Seaplane Base experiences more total operations than regional hub airports Kodiak and King Salmon combined and more operations than Lake Hood in Anchorage. Though non-towered, total operations at Ketchikan Harbor would rank sixth overall when compared with all towered airports statewide (Table 2).

**Table 2. Total Operation Rankings, 1998**

Airport	Total Operations	Rank
Anchorage	311,590	1
Merrill Field	207,028	2
Juneau	153,717	3
Bethel	142,234	4
Fairbanks	140,711	5
<b>Ketchikan Harbor</b>	<b>80,000 – 100,00<sup>1</sup></b>	<b>6</b>
Anchorage Lake Hood	86,686	7
Kenai Municipal	74,842	8
Kodiak	39,009	9
King Salmon	28,644	10

Source: FAA APO Data System. (<http://www.apo.data.faa.gov/>)

<sup>1</sup> Based on personal communication with Ketchikan FSS staff. August 31, 1999.

Among Flight Service Stations, Ketchikan Harbor ranks second by total aircraft contacted, fourth by total flight services, and fifth by total pilot briefs (Table 3). The second place ranking for total aircraft contacted is a reflection of the special Federal Aviation Regulations (FAR) in effect for Ketchikan airspace and are discussed in the following sections.

**Table 3. Flight Service Station Rankings by Service, 1998**

Airport	Aircraft Contacted	Rank	Airport	Flight Services	Rank	Airport	Pilot Briefs	Rank
Kenai	157,743	1	Kenai	547,673	1	Kenai	119,299	1
<b>Ketchikan H.</b>	<b>101,301</b>	<b>2</b>	Fairbanks	254,056	2	Fairbanks	48,113	2
Fairbanks	70,774	3	Juneau	166,396	3	Juneau	21,886	3
Juneau	65,304	4	<b>Ketchikan H.</b>	<b>142,627</b>	<b>4</b>	Dillingham	16,842	4
Dillingham	64,854	5	Dillingham	120,368	5	<b>Ketchikan H.</b>	<b>10,245</b>	<b>5</b>

Source: FAA APO Data System. (<http://www.apo.data.faa.gov/>)

## 4.0 AIR SPACE AND AIR TRAFFIC MANAGEMENT

### 4.1 Air Space

Aircraft departing or arriving from any of the above facilities and transient aircraft passing through the Narrows area are subject to Class E airspace features: A general controlled airspace permitting VFR and IFR operations but requiring 3 statute miles of visibility and 500 feet below, 1,000 feet above and 2,000 feet horizontal minimum distances from clouds for VFR operations. Specific Federal Aviation Regulations in the Tongass Narrows permit both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) within the following parameters: (1) Air Traffic Control (ATC) clearance and two-way communications are required for all IFR

operations. (2) VFR operations must be conducted within the established Class E minimums unless a special VFR clearance is granted.

Additionally, Federal Aviation Regulation (FAR) Part 93, Subpart M, Sections 93.153 and 93.155 prescribe, “special air traffic rules and communications requirements for persons operating aircraft under VFR: (a) To, from, or in the vicinity of the Ketchikan International Airport or Ketchikan Harbor. (b) Within the air space below 3,000 feet mean sea level (MSL) within the lateral boundary of the surface area of the Ketchikan Class E airspace regardless of whether that airspace is in effect.” See Appendix B.

FAR Part 93, Subpart M, Section 93.153 prescribes the following communications requirements when operating within Ketchikan air space:

- (a) When the Ketchikan Flight Service Station is in operation, no person may operate in the airspace, or taxi onto the runway at Ketchikan International Airport, unless that person has established two-way radio communications with the Ketchikan Flight Service Station for the purposes of receiving traffic advisories and continues to monitor the advisory frequency at all times while operating within the specified airspace.
- (b) When the Ketchikan Flight Service Station is not in operation, no person may operate an aircraft within the airspace, or taxi onto the runway at Ketchikan International Airport, unless that person continuously monitors and communicates, as appropriate, on the designated common traffic advisory frequency as follows:
  - (1) For inbound flights; Announces position and intentions when no less than 10 miles from the Ketchikan International Airport, and monitors the designated frequency until clear of the movement area on the airport and the Ketchikan harbor.
  - (2) For departing flights; Announces position and intentions prior to taxiing onto the active runway on the airport or onto the movement area of Ketchikan Harbor and monitors the designated frequency until outside the airspace described above and announces position and intentions upon departing that airspace.
- (c) Notwithstanding the provisions of paragraphs (a) and (b) of this section, if two-way radio communications failure occurs in flight, a person may operate an aircraft within the airspace, and land, if weather conditions are at or above basic VFR weather minimums.

FAR Part 93, Subpart M, Section 93.155 prescribes the following aircraft operation requirements when operating with Ketchikan air space:

- (a) When an advisory is received from the Ketchikan Flight Service Station stating that an aircraft is on final approach to the Ketchikan International Airport, no person may taxi onto the runway of that airport until the approaching aircraft has landed and has cleared the runway.

- (b) Unless otherwise authorized by ATC, each person operating a large airplane or a turbine engine powered airplane shall—
- (1) When approaching to land at the Ketchikan International Airport, maintain an altitude of at least 900 feet MSL until within three miles of the airport; and;
  - (2) After takeoff from the Ketchikan International Airport, maintain runway heading until reaching an altitude of 900 feet MSL.

Based on Federal Air Regulations (F.A.R.), Part 77 *Objects Affecting Navigable Airspace* was developed to control the height of objects in the vicinity of the airport to ensure that airspace and approaches to each runway are protected from hazards that could affect the safe and efficient operation of the airport. The Ketchikan International Airport Part 77 airspace plan (Appendix A) is a graphic description depicting existing airspace penetrations. The current Ketchikan International Airport Part 77 Airspace Plane lists 51 penetrations. As indicated in the figure, the preponderance of the penetrations are related to tree height and ground areas penetrating the horizontal and conical surface areas.

## 4.2 Air Traffic Management

Ketchikan air space is not controlled by a federally approved air traffic control tower. Classified as Class E air space, aircraft activity is monitored by the Ketchikan Flight Service Station (FSS). Located on the third, fourth, and fifth floors of the Ketchikan International Airport terminal, the FSS provides air traffic advisories to aircraft operating within Ketchikan air space. Additionally, FSS personnel attempt to provide pilots with current on water vessel activity information to assist in take off and landing procedures. Though pilots entering Ketchikan air space are not federally required to adhere to the advisories of FSS personnel, they are required to adhere to the above FARs and it is to their benefit and the safety of themselves and others to perform operations as directed by FSS personnel.

### 4.2.1 Recommended VFR Arrivals and Departures

The majority of operations in Ketchikan air space are conducted by small single engine floatplanes. As a result of such heavy traffic in a topographically constricted area subject to frequent inclement weather, the Tongass Pilots Association (TPA) has produced the *Ketchikan Recommended Standard VFR Arrival and Departure Procedures and Patterns* in an effort to enhance aviation safety and mitigate noise associated with aircraft operations. This document recommends standard operating practices and procedures for VFR operations in Ketchikan airspace. Specific VFR operating procedures are outlined below.

- ◆ See and be seen
- ◆ Avoid flight preoccupation
- ◆ Pay strict attention to radio traffic advisories
- ◆ Check for traffic prior to water takeoff
- ◆ Update your position
- ◆ Use landing lights
- ◆ Use common courtesy
- ◆ Report when you are no longer a traffic factor
- ◆ Expect the unexpected
- ◆ Plan your takeoff and landing
- ◆ Avoid approach/departure course of airport
- ◆ Use extreme caution
- ◆ Use initial VFR reporting points
- ◆ Report direction of takeoff
- ◆ Adhere to arrival/departure pattern selection criteria
- ◆ Monitor 'Pattern-In-Use' announcements

Figure 2 shows the recommended VFR flight patterns for fixed wing aircraft and rotorcraft departing from or arriving to the Ketchikan Harbor, Airport Dock and the Tongass Narrows. Figure 3 shows the recommended VFR flight patterns for fixed wing aircraft departing from or arriving to the Ketchikan International Airport.

#### **4.2.2 Standard VFR Operational Minimums**

Pilots may initiate a standard VFR arrival or departure when ceiling conditions are 1,000 feet or greater and visibility is three miles or greater. Except for the purposes of approach and departure procedures, the standard minimum altitude for a commercial operator is 500 feet above MSL.

#### **4.2.3 Special VFR Operational Minimums**

Climactic conditions in the Tongass Narrows recurrently result in recurrent conditions that are well below VFR minimums and require special VFR clearances for VFR operations. Ketchikan FSS staff indicate special VFR clearances are issued when either ceiling levels fall below 1,000 feet or visibility falls below three miles (McDonald, 1999). Under special VFR clearance, some FAR part 135 operators, by exemption, are permitted to operate below 500 feet MSL, but not all (Girard, 1999).

From 1996 to 1998, excluding the last three months in 1998, special VFR clearances were granted by the Ketchikan FSS at an average rate of five per hour. Additionally, during the 1,004-day period, there were 117 days where more than ten special VFR clearances were granted. Approximately twelve percent of all days over the last 2-¾ years have had two or more hours below VFR minimums (Chenhall October 2, 1999).

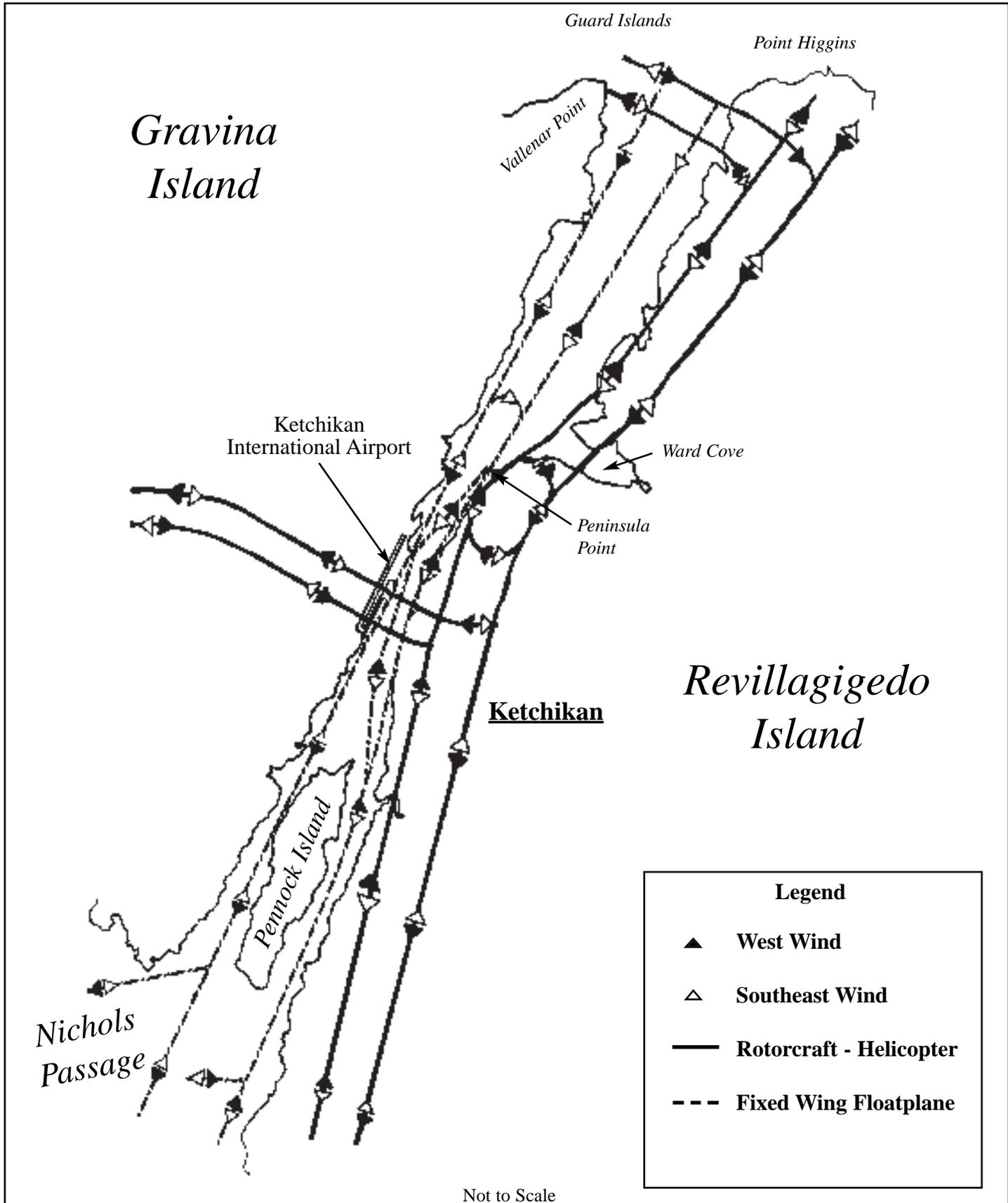
#### **4.2.4 Standard IFR Operational Minimums**

Pilots may initiate a standard IFR arrival or departure when the ceiling level is at or above 1,000 feet and visibility is clear to three miles (Air Traffic, 1999).

#### **4.2.5 Special IFR Operational Minimums**

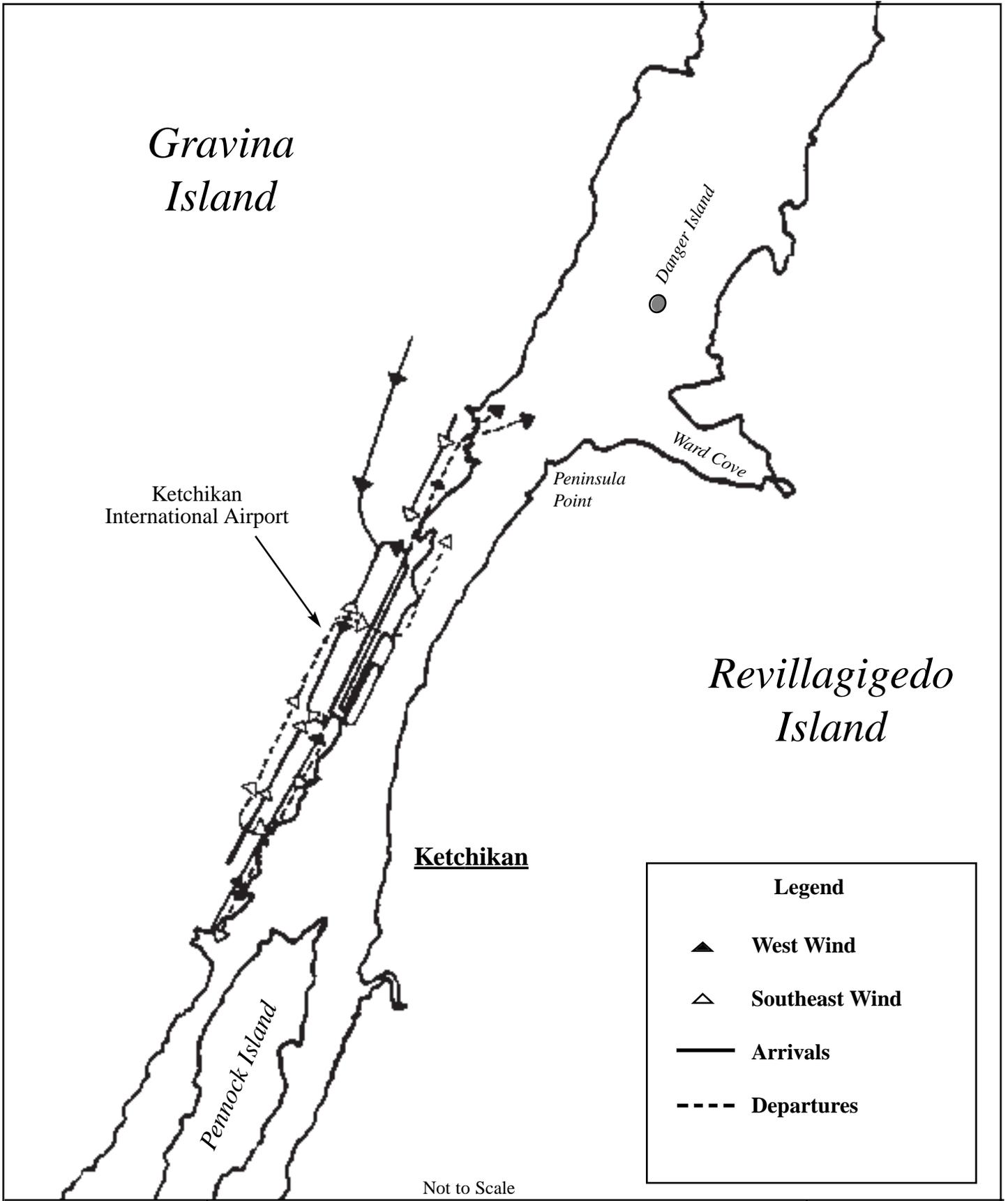
Alaska Airlines has approved special IFR arrival and departure procedures that allow IFR arrivals to both runway ends and IFR departures in both directions when ceiling conditions are 500 feet or greater and horizontal visibility is 3,960 feet or greater (Air Traffic, 1999). Pilots will not initiate an approach unless the prevailing visibility and ceiling level is at or above required special IFR approach minimums (Girard, 1999).

With the addition of advanced technologies in the near future to the Ketchikan International Airport, it can be expected that Alaska Airlines will be able to operate as low as 200 feet MSL and 1,800 RVR on arrival and as low as 1,200 feet RVR on takeoff (Girard, 1999).



**Recommended VFR Arrival and Departure Patterns (Ketchikan Harbor, Airport Dock, Tongass Narrows)**

**Figure 2**



**Recommended VFR Arrival and Departure Patterns (Ketchikan International Airport)**

**Figure 3**

## 5.0 TONGASS NARROWS WATERWAY

### 5.1 Code of Federal Regulations

Upon landing in the Tongass Narrows, seaplanes immediately fall under the jurisdiction of the U.S. Coast Guard (USCG). Seaplanes are now referred to as vessels and are required to adhere to the operating procedures as prescribed by law under the Code of Federal Regulations (CFR) Title 33, Volumes 1 and 2, Parts 110, 162, and 165.

CFR Title 33, Part 110, Section 231 prescribes an anchorage area in which no vessel, other than large passenger vessels of over 1600 gross tons, may anchor without the express consent of the Captain of the Port Southeast Alaska. Additionally, this section requires vessels using propulsion machinery to proceed through the anchorage by the most direct route and without unnecessary delay, prohibiting sudden course changes.

CFR Title 33, Part 165, Section 1708 designates a safety zone for the annual fireworks display on the fourth of July. This safety zone becomes effective on July 3 each year at 10 p.m. and terminates at the conclusion of the fireworks display, approximately 2:30 a.m. July 5 unless sooner terminated by the Captain of the Port.

CFR Title 33, Part 162, Section 240 establishes a maximum speed limit of 7 knots for vessels over 20 feet in length operating in the Tongass narrows. This speed limit is effective between Idaho Rock and Charcoal Point. Additionally, the regulation states that no vessel shall unreasonably obstruct passage or progress of other vessels either by moorage or slow passage. The regulation also states that no vessel shall moor or anchor to any structure of the United States other than mooring piers, wharves, and floats, without the consent of the Captain of the Port.

### 5.2 Recommended Waterway Use

As a result of the high traffic volume and the geography of the Tongass Narrows, the USCG has prepared the *Tongass Narrows Voluntary Waterway Use Guide*, which presents recommended guidelines for the operation of all vessels in the Tongass Narrows. A 'vessel' is defined as every description of watercraft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on water. The bullets below summarize general operating guidelines for all vessels operating on the Tongass Narrows.

- ◆ All vessels are required to operate in accordance with the International Regulations for Prevention of Collisions at Sea, 1972 (72 COLREGS)
- ◆ All vessels equipped with a VHF Marine band radio should monitor channel 16 when underway.
- ◆ All Mariners are responsible for the wake created by their vessel.
- ◆ When transiting the Tongass Narrows, exercise caution, maintain extra vigilance and be courteous.
- ◆ Contact the local harbor master's office on VHF channel 73 for moorage information.
- ◆ Become familiar with the suggested operating areas prior to operating your vessel in the Narrows.

More specific guidelines are presented for the operation of floatplanes on the Tongass Narrows.

- ◆ Floatplanes are considered vessels when the plane is on the water and as such are subject to the International Navigation Regulations (72 COLREGS).

- ◆ It is recommended that 'step taxiing' be minimized. "Idle Taxiing" is preferred.
- ◆ Floatplane operators should monitor small vessel traffic (kayaks and others) during landings and takeoffs.
- ◆ Floatplane operators should keep a close lookout for small vessels screened by cruise ships.
- ◆ To avoid congestion, floatplane operators are encouraged to extend their taxi to the west when operating under the 'East Wind Pattern'.
- ◆ Pilots are reminded to keep centered in the channel to reduce the risk of being surprised by a vessel leaving waterfront facilities.
- ◆ Pilots should avoid operating in the vicinity of the airport ferry when using the Ketchikan International Airport floatplane facilities.
- ◆ Floatplane operators, when landing or taking off should avoid impeding or surprising operators of nearby vessels.

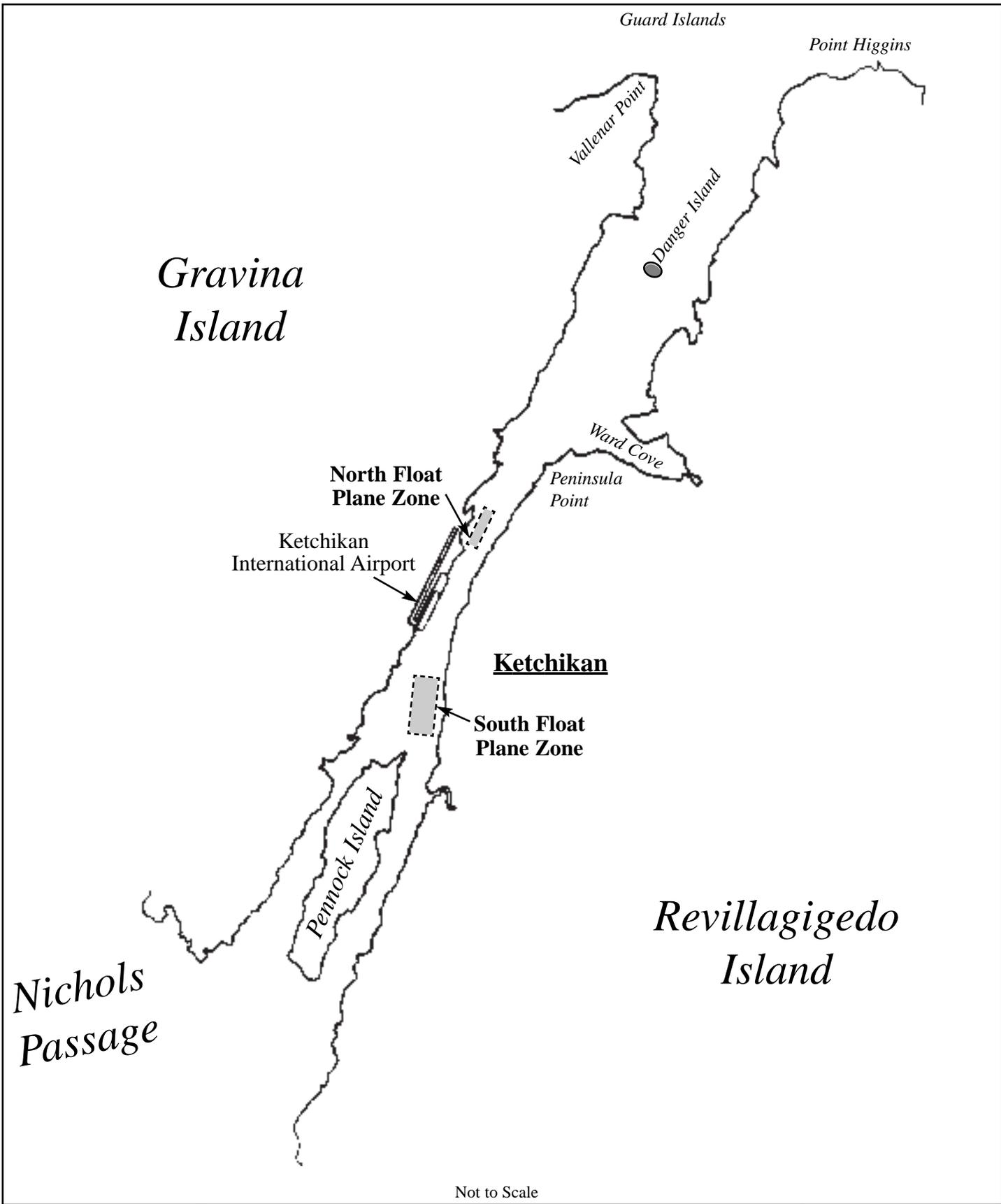
The USCG *Tongass Narrows Waterway User Guide* recommends two areas for the operation of floatplanes on the Tongass Narrows; the North Floatplane Zone and the South Floatplane Zone (Figure 4). Furthermore, the guide identifies the following areas as navigational restrictions (Figure 5). These areas and vessel navigation requirements are the topic of discussion in a separate, yet complimentary report and should be consulted further for navigational issues.

- ◆ West Channel, Tongass Narrows, vicinity of Clam Cove. This area is bounded by Gravina Island on the west and Pennock Island on the east.
- ◆ East Channel, Tongass Narrows from Idaho Rock to the USCG Base. This area lies between Pennock Island on the west and Revillagagedo Island on the east.
- ◆ North Channel from Danger Island to South end of Bar Harbor.

## 6.0 KETCHIKAN INTERNATIONAL AIRPORT MASTER PLAN UPDATE

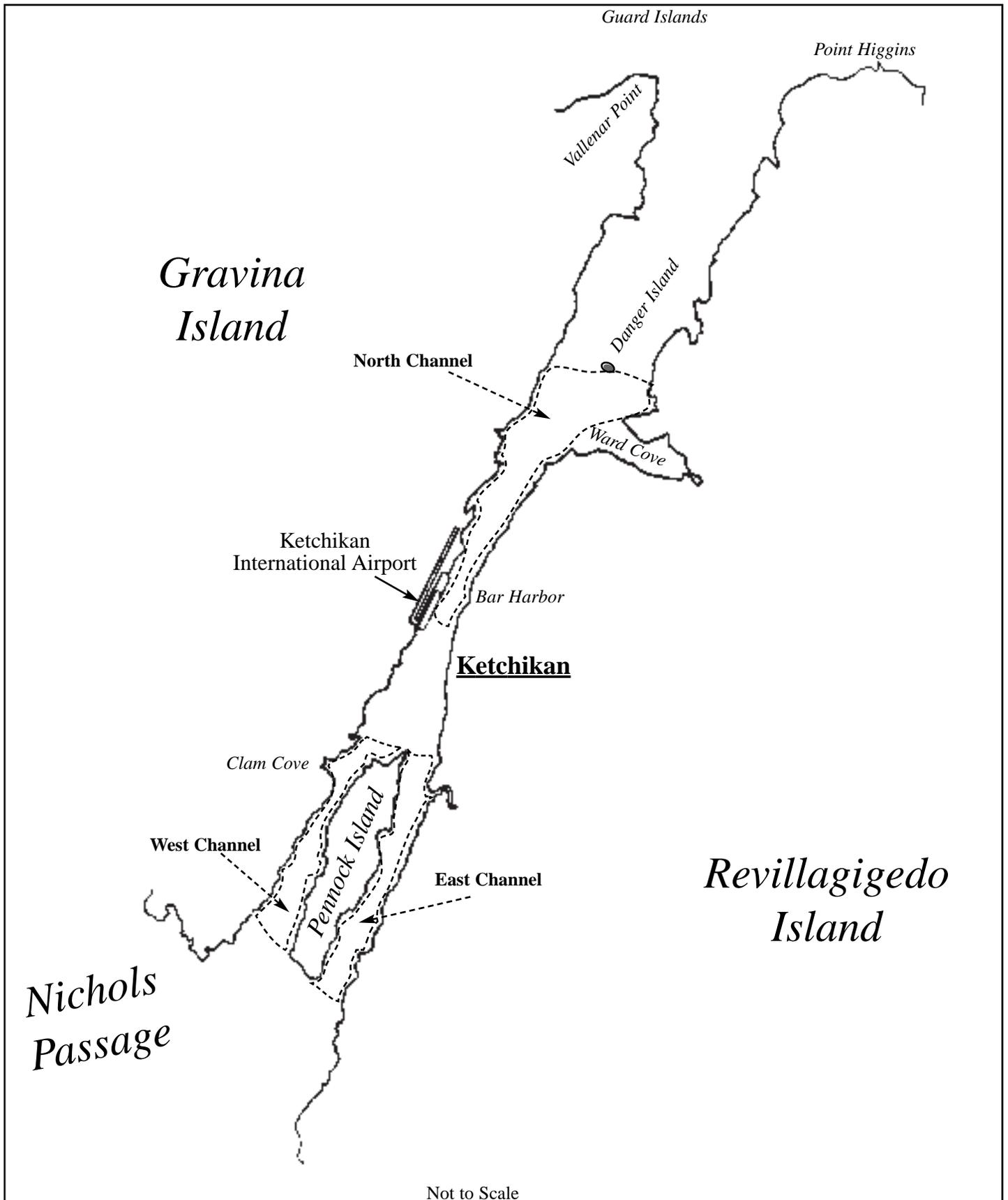
The Alaska Department of Transportation & Public Facilities is currently revising the Ketchikan International Airport Master Plan. Though currently incomplete and in a draft stage, the resulting updated airport master plan will likely recommend airport improvement projects to accommodate the identified demand-capacity issues. Preliminary planning documentation for the Ketchikan International Airport master plan update indicates that existing airfield capacity will be sufficient through the 2018 planning horizon. However, some justification is presented for the development of a full or partial length parallel taxiway with or without a mid-length exit. Preliminary planning also indicates that seaplane base facilities within the project area (Murphy's Pullout, Peninsula Point, and Tongass Narrows) also have sufficient existing capacity through the planning period. To date, airport development alternatives have not yet been identified. It should be noted that the preliminary planning document has yet to be reviewed by the ADOT&PF and FAA.

The preliminary documentation does indicate existing deficiencies with the Runway Safety Area (RSA) and the passenger terminal complex. Alternatives designed to address the RSA have not yet been identified. A major terminal improvement plan will be completed in the fall of the year 2000. The improvements proposed will be designed to provide sufficient capacity through the 2018 planning period.



**Recommended Float Plane Zones**

**Figure 4**



**U.S.C.G. Identified Navigational Restrictions**

**Figure 5**

## 7.0 POTENTIAL IMPACTS TO AVIATION

Improved access between Gravina Island and Revallgigedio Island could affect aviation activity in the Tongass Narrows corridor. Submerged tubes or tunnels, by their very nature would not likely interfere with local aviation patterns or activity. Bridges or other hard-links above MSL, however, have the potential, depending on the location and configuration, to impact aviation conditions.

### 7.1 Floatplanes

As the primary aviation users of the Tongass Narrows waterway, it is expected that floatplanes would be most affected by a bridge alternative. These types of aircraft routinely utilize the Tongass Narrows for takeoff and landing procedures at three seaplane bases (Ketchikan Airport, Ketchikan Harbor, and Murphy's Pullout) throughout the project corridor. During inclement weather, exempt commercial operators flying under special VFR authorization frequently fly at altitudes ranging from 200 feet to 300 feet (McDonald, 1999). Considering the frequency of inclement weather and accompanying authorization of special VFR operations, the potential for floatplane aircraft initiating an arrival at or below an altitude of 500 feet MSL is considerable. A bridge located within the recommended flight patterns and more specifically in the approach zones for any of the three seaplane facilities would potentially require alteration of the recommended flight patterns and/or Federal Aviation Regulations governing special VFR operations.

### 7.2 Wheeled Aircraft

Fixed wheeled aircraft, such as those operated by Alaska Airlines and others have less potential to be affected by a bridge alternative. These aircraft follow recommended flight patterns over the eastern shore of Gravina Island and operate from the Ketchikan International Airport. Under the recommended VFR arrival and departure patterns, aircraft are to maintain the runway heading until they have reached an altitude of 900 feet or greater, weather permitting. For pilots operating under special VFR minimums this altitude would be reduced. Pilots operating under special IFR authorization will not initiate an arrival to the Ketchikan International Airport if ceiling conditions fall below 500 feet. Though a bridge alternative would not immediately pose a flight hazard to wheeled aircraft, it is probable that it would penetrate the airport's airspace thereby requiring a revision of KIA's Part 77 Airspace Plan.

### 7.3 Helicopters

Recommended flight patterns for helicopters are established over the western shore of Revillagigedio Island. Subject to standard and special VFR minimums, helicopter operation has less potential for impact from a bridge alternative with the exception of two areas. The Tongass Aircraft and Pilots Association has established helicopter crossings between Revillagigedio Island and Gravina Island at two locations; between Point Higgins and Vallenar Point, and perpendicular to the Ketchikan International Airport. Impacts would be increased if a bridge were located in either of these areas and could potentially require a revision of the recommended flight patterns and/or FAR's governing special VFR operations.